allowable rotational speed and/or maximum allowable mass flow rate, an operating point for a take-off or landing operation and/or for cruise flight.

[0011] Surprisingly, it has been found that by a certain combination of the initially substantially independent design parameters of total blade count and total pressure ratio, a particularly advantageous, in particular low-noise, efficient and/or compact turbofan aircraft engine can be designed if specific minimum values are met for both the total pressure ratio and one or more stage pressure ratios of the second turbine and if the total stage count is within a narrowly defined range.

[0012] Accordingly, in accordance with one aspect of the present invention, the second turbine of a turbofan aircraft engine is designed such that a quotient of the total blade count N_{BV} of the second turbine divided by 110, in particular divided by 100, is less than a difference of the total pressure ratio (p_1/p_2) of the second turbine minus one:

$$N_{BV}<110\cdot[(p_1/p_2)-1] \tag{1}$$

or respectively,

$$N_{BV}<100\cdot[(p_1/p_2)-1], \tag{1a}$$

where the total pressure ratio of the second turbine is greater than 4.5, in particular greater than 5:

$$(p_1/p_2)>4.5 \tag{2}$$

or respectively,

$$(p_1/p_2)>5, \tag{2a}$$

and at least one stage pressure ratio Π, in particular each stage pressure ratio of the second turbine is at least 1.5, in particular at least 1.6, in particular at least 1.65:

$$\Pi\geq 1.5 \tag{3}$$

or respectively,

$$\Pi\geq 1.5\ \forall\text{all stages} \tag{3'}$$

or respectively,

$$\Pi\geq 1.6,\ \text{in particular } 1.65 \tag{3a}$$

or respectively,

$$\Pi\geq 1.6,\ \text{in particular } 1.65\ \forall\text{all stages}, \tag{3a'}$$

and where the total stage count n_{St} of the second turbine is at least two and no greater than five, in particular no greater than four:

$$2\leq n_{St}\leq 5 \tag{4}$$

or respectively,

$$2\leq n_{St}\leq 4. \tag{4a}$$

[0013] Additionally or alternatively to such a combination of total blade count and total pressure ratio in conjunction with the consideration of limits for the total pressure ratio on the one hand and the total stage count on the other hand in accordance with the above conditions (1) through (4a), a particularly advantageous, in particular low-noise, efficient and/or compact turbofan aircraft engine can surprisingly also be designed by a certain combination of the initially substantially independent design parameters of total pressure ratio and total stage count.

[0014] Accordingly, in accordance with a further aspect of the present invention, which may be combined with the aspect described above, the second turbine of a turbofan aircraft engine may be designed such that a quotient of the total pressure ratio (p_1/p_2) divided by the total stage count n_{St} is greater than 1.6, in particular greater than 1.65:

$$((p_1/p_2)/n_{St}>1.6 \tag{24}$$

or respectively,

$$((p_1/p_2)/n_{St}>1.65. \tag{24a}$$

[0015] Moreover, it has been found that a particularly advantageous, in particular low-noise, efficient and/or compact turbofan aircraft engine can be designed if a parameter defined by a product of an exit area of the second turbine and a square of a rotational speed of the second turbine at the design point is not less than a certain threshold value, and if, in addition, specific minimum values are met for both the stage pressure ratio of one or more turbine stages of the second turbine and a blade tip velocity of a turbine stage, particularly of a first or last turbine stage, of the second turbine at the design point.

[0016] Accordingly, in accordance with one aspect of the present invention, the second turbine of a turbofan aircraft engine is designed such that a product of an exit area (AL) of the second turbine and a square of a rotational speed n of the second turbine at the design point; i.e., in particular, a product of the exit area and a square of the maximum allowable rotational speed n_{max}, is at least $4.5\cdot 1010$ [$in^2\cdot rpm^2$] or 8065 [m^2/s^2], in particular at least $5\cdot 1010$ [$in^2\cdot rpm^2$] or 8961 [m^2/s^2]:

$$A\cdot n^2_{(max)}\geq 4.5\cdot 1010\ [\text{in}^2\cdot\text{rpm}^2] \tag{5}$$

or respectively,

$$A\cdot n^2_{(max)}\geq 5\cdot 1010\ [\text{in}^2\cdot\text{rpm}^2], \tag{5a}$$

where at least one stage pressure ratio Π, in particular each stage pressure ratio, of the second turbine is at least 1.5, in particular at least 1.6, in particular at least 1.65:

$$\Pi\geq 1.5 \tag{3}$$

or respectively,

$$\Pi\geq 1.5\ \forall\text{all stages} \tag{3'}$$

or respectively,

$$\Pi\geq 1.6,\ \text{in particular } 1.65 \tag{3a}$$

or respectively,

$$\Pi\geq 1.6,\ \text{in particular } 1.65\ \forall\text{all stages}, \tag{3a'}$$

and a blade tip velocity u_{TIP} of at least one turbine stage, particularly of the first or last turbine stage, of the second turbine at the design point is at least 400 meters per second, in particular at least 450 meters per second:

$$u_{TIP}\geq 400\ [\text{m/s}] \tag{6}$$

or respectively,

$$u_{TIP}>450\ [\text{m/s}]. \tag{6a}$$